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ABSTRACT

The programs of the National Science Foundation (NSF), whose mission is to support basic research, science education, and general science literacy, should be seriously considered by two-year college science faculty and administrators as alternative sources of funding to accomplish institutional and personal objectives. The three divisions of NSF, each with its own focus, fund the majority of efforts to support science education. Within the Scientific Personnel Improvement Division are the Women in Science Program and the Science Faculty Professional Development Program. Three programs of the Science Education Resources Improvement Division which seem particularly relevant for community colleges are Local Course Improvement, Instructional Scientific Equipment Program, and Comprehensive Assistance to Undergraduate Science Education. The Science Education Development and Research Division operates two programs of interest, Development in Science Education and Research in Science Education. The Office of Science and Society is another source of funding through the Public Understanding of Science Program. In addition to describing NSF and each of these programs, this paper considers the reasons for low two-year college participation in the programs, institutional activities which can facilitate successful fund seeking, how to succeed with NSF proposals, and the advantages of fund seeking. (AYC)

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RESOURCE PAPER NO. 14

Opportunities for Improving Science Education Using National Science Foundation Grants

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November, 1977

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The author was on assignment during 1976-77 to the National Science Foundation, Division of Science Education Resources Improvement. The views expressed are solely the author's and are not necessarily those of the National Science Foundation.

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An Affiliate Council of The American Association of Community and Junior Colleges

Opportunities for Improving Science Education Using National Science Foundation Grants

Introduction

Community junior college and technical institute science offerings often are subject to weaknesses and needs for which the usual channels of financial support offer little assistance. Adequate funding to address these college needs in science education is often impossible to obtain from the institution's regular sources of revenue. However, alternate sources of funds are available on a competitive basis from the National Science Foundation.

The focus of the problem areas in two-year colleges may be in the materials available, the present curricula taught, concerns relating to faculty motivations and currentness, questions of program relevance to student and community needs, or in broad areas such as the general modes of delivery of science education in use. Needs may reflect the diversity of student populations (in terms of skills, abilities, age, geographical, or other factors), changing or emerging technologies, or pressures to fit programs containing extensive requirements for knowledge and skills into the constraint of a two-year program. Local requirements for continuing education especially in the area of retraining and upgrading of professional competencies, community requests for offerings to promote general science literacy, or problems associated with faculty isolation and the lack of easy inter-institutional communication and cooperation are other examples of problems sometimes faced by two-year college science educators.

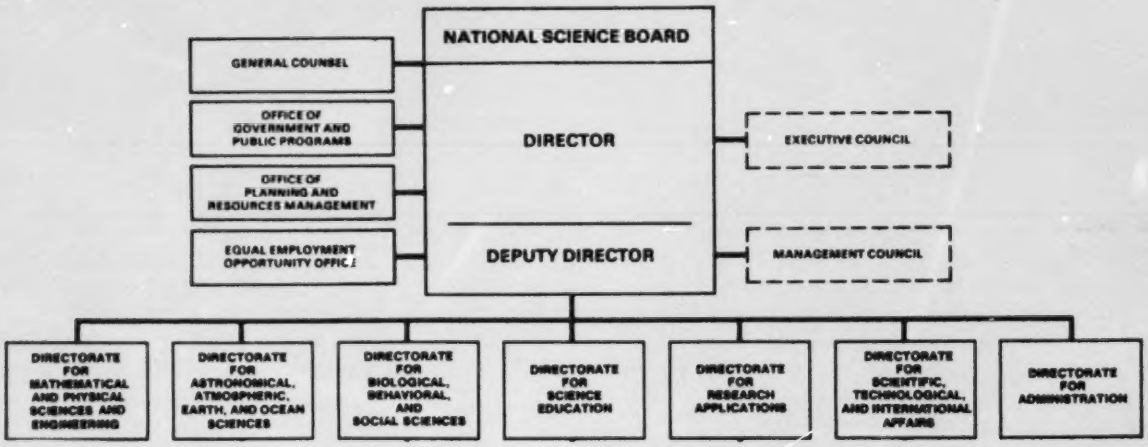
Because of the general shortage of money available to accomplish institutional or personal professional objectives in problem areas like those just mentioned, it would appear that the NSF programs should be given serious consideration by both science faculty and administrators. In the following sections the Foundation and some of its programs of particular appropriateness to community and junior colleges and technical institutes will be discussed. Some suggestions for administrative actions to promote the process of successful fund seeking as well as consideration of common pitfalls in proposal writing will also be included.

The National Science Foundation

The National Science Foundation is an independent Federal agency which receives its support and mandate from Congress. NSF's original mission, and still its main thrust, is to strengthen U.S. science efforts through the support of basic research and science education. In addition, since 1968, the Foundation has supported applied research on selected national problems. Recently, Congress has been bringing more emphasis to bear on the issue of science literacy for the general public. Figure 1 shows the Foundation's current organizational chart.

Figure 1

NATIONAL SCIENCE FOUNDATION


NATIONAL SCIENCE BOARD
GENERAL COUNSEL
OFFICE OF GOVERNMENT AND PUBLIC PROGRAMS
OFFICE OF PLANNING AND RESOURCES MANAGEMENT
EQUAL EMPLOYMENT OPPORTUNITY OFFICE
DIRECTOR
DEPUTY DIRECTOR
EXECUTIVE COUNCIL
MANAGEMENT COUNCIL
DIRECTORATE FOR MATHEMATICAL AND PHYSICAL SCIENCES AND ENGINEERING
DIRECTORATE FOR ASTRONOMICAL, ATMOSPHERIC, EARTH, AND OCEAN SCIENCES
DIRECTORATE FOR BIOLOGICAL, BEHAVIORAL, AND SOCIAL SCIENCES
DIRECTORATE FOR SCIENCE EDUCATION
DIRECTORATE FOR RESEARCH APPLICATIONS
DIRECTORATE FOR SCIENTIFIC, TECHNOLOGICAL, AND INTERNATIONAL AFFAIRS
DIRECTORATE FOR ADMINISTRATION

There are six operating Directorates and an Administrative Directorate. One of the six Directorates supports Science Education. Table 1 shows budget data for FY 1976, FY 1977 and FY 1978.

Table 1

National Science Foundation Budget Program Comparisons FY 1976-1978
(Millions of dollars)

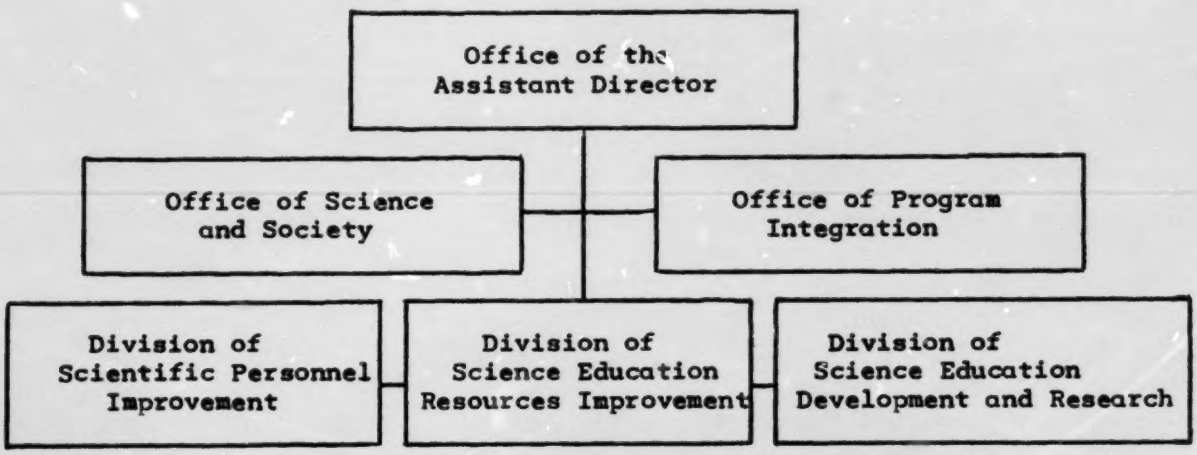
	FY 1976	FY 1977	FY 1978
Mathematical and Physical Sciences and Engineering	192.3	223.9	246.5
Astronomical, Atmospheric, Earth and Ocean Sciences	171.0	188.8	210.5
U.S. Antarctic Program	48.6	45.3	47.5
Biological, Behavioral, and Social Sciences	109.0	126.6	142.5
Science Education	62.5	74.3	73.2
Research Applied to National Needs	72.0	67.6	63.0
Scientific, Technological and International Affairs	22.4	20.6	20.9
Program Development and Management	42.2	45.8	47.8
Special Foreign Currency Appropriation	4.4	5.0	4.9
Basic Research Stability Grants (New program)	___	___	4.5
Total	724.4	797.7	861.3

The Science Education effort accounts for approximately nine per cent of the total Foundation budget. It is to this nine per cent, or approximately 75 million dollars, that two-year colleges must look for assistance in improving the quality of content and delivery of their science education efforts.

The Science Education Directorate

The Science Education Directorate is described in the organizational chart, Figure 2.

Figure 2


Office of the Assistant Director
Office of Science and Society
Office of Program Integration
Division of Scientific Personnel Improvement
Division of Science Education Resources Improvement
Division of Science Education Development and Research

This Directorate is comprised of three Divisions, each headed by a Division Director; an Office of Science and Society; and an Office of Program Integration. The latter is an internal evaluation component which does not directly fund proposals for improvements in science education at individual institutions. The three Divisions, Scientific Personnel Improvement. (SMI), Science Education Resources Improvement (SERI), and Science Education Development and Research (SEDR), each with its own focus, fund the majority of the Foundation's efforts to support science education. Table 2 shows budget data for the separate units in the Science Education Directorate (page 4). For most of the Foundation's programs science is broadly interpreted to include the physical, biological, mathematical, engineering, and social sciences. Engineering technologies, the history and philosophy of science, and interdisciplinary sciences overlapping two or more of the above are also eligible for support. It appears that many two-year college faculty are unaware of the range of disciplines that the NSF will support and thus do not consider the Foundation programs as a potential source of assistance.

Science Education Programs FY 1976-1978 (Millions of Dollars)

	FY 1976	FY 1977	FY 1978
Scientific Personnel Improvement	24.9	30.4	31.5
Science Education Resources Improvement	24.3	28.4	27.9
Science Education Development and Research	10.9	11.2	8.7
Science and Society	2.4	4.3	5.1
Total	62.5	74.3	73.2

Table 2

I. The Scientific Personnel Improvement Division (SPI) focuses on personnel, students, and faculty. Through fellowships, traineeships, and other activities this Division seeks to support the development of scientists and science educators, and to increase the entry of women and minorities into science careers. Of particular interest to two-year colleges are the SMI Women in Science and the Science Faculty Professional Development programs. The Women in Science Program funds workshpps designed to motivate women to consider majoring in science by providing information and advice on career options or other practical matters. With the entry level for many career fields not traditionally attractive to women being offered at two-year postsecondary institutions, and with these colleges being the re-entry point for so many older women returning to continue their formal education, it would seem that this program is a natural to help the institutions facilitate the career guidance process. The Science Faculty Professional Development Program funds individual faculty in work or study programs to improve the effectiveness of their teaching. Awards are made to faculty with a current academic appointment who will have completed five or more years of undergraduate science teaching at the time of application. Support is at the awardee's current salary level up to a maximum of $27,000 per year. Many prior awardees have used this support to start or continue graduate studies not otherwise available to them. Considering the problems of maintaining motivation, enthusiasm, and currentness faced by many community college faculty in professionally isolated environments, this program would seem to offer great opportunity. However, in 1977 only 118 out of a total of 1,131 applications (ten and one-half percent) came from two-year colleges. About ten percent of the awards in this program were made to two-year collgge faculty in 1977 reflecting in part the application pressure.

II. The Science Education Resources Improvement Division (SERI) focuses on institutional grants to strengthen the capabilities of schools for science education. The mechanism used in SERI is the block program. Block programs have specifically defined objectives, eligibility requirements, fiscal limits, proposal formats, peer review criteria, and annual closing dates for proposal submissions. SERI's block programs are carefully described in guidelines that are available on request. Individual programs of interest to two-year colleges include programs to support both highly focused projects dealing with a single course (or even a component of a course) and broadly focused projects involving a department-wide (or even college-wide) effort at improvement. Three SERI programs appear to be particularly relevant for community colleges, (1) Local Course Improvement (LOCI), (2) Instructional Scientific Equipment Program (ISEP), and (3) Comprehensive Assistance to Undergraduate Science Education (CAUSE). Each of these will be considered in some detail. Specifics will apply to the FY 77 guidelines, but FY 78 guidelines are similar except in minor details.

One point to be stressed is that SERI programs all address local problems. Local needs and improvements targeted to fit the institutional context are sufficient justification for proposals to SERI programs. On the other hand, if the local problem addressed is also one of broader or even national significance, that too should be stressed as an added value.

(1) The Local Course Improvement Program (LOCI) will provide support of up to $25,000 for imaginative undergraduate science teaching projects highly focused on specific instructional needs. Undergraduate instructional activities including courses or discrete parts of a course intended for science majors, non-science majors, or both are appropriate. While some small purchases of equipment will be supported in LOCI, the program is not intended to principally support equipment acquisition. LOCI will fund costs associated with activities such as materials or curriculum development, software production, innovation, evaluation, testing, and experimentation. In one view, the LOCI funds are primarily to fund salaries or buy "time" for professionals and their support staff to carry out the project's goals. This program is perhaps the best Foundation program in relation to two-year college needs. To activate a proposal only one faculty member, well aware of the needs in one course and motivated to act, is required. With over 1200 two-year colleges operating and with the only institutional proposal limit being one proposal for every college department, one might expect that LOCI would receive thousands of proposals from two-year colleges.

In 1977 LOCI received 750 proposals, 625 from non-two-year colleges, and only seventy-five from two-year colleges. The success ratio in each group was the same. The two-year college philosophy stresses excellence in teaching as a primary goal. Two-year college proposal pressure in programs like LOCI suggests that other objectives and motivations may be dominating the teaching environment at many institutions. The issue is a broad one, but for those looking for resources, LOCI is available with a substantially increased 1978 budget.

(2) The Instructional Scientific Equipment Program (ISEP) is a narrowly focused program to facilitate implementation of new or improved instructional programs by providing partial support to purchase equipment. A success-

ful proposal must show how the planned project will improve the present program of instruction, how the projected change is appropriate to both the student audience and the department's priorities, and how the equipment selected is suitable and necessary for the planned improvement. ISEP will fund up to $20,000 per award which must be matched by at least fifty per cent non-Federal sources. Multiple proposals are allowed from each institution with limits defined by the enrollments. In 1977 schools could submit a maximum of from two up to five proposals, depending on the Fall FTE undergraduate enrollment. Funds could be used to purchase laboratory and demonstration equipment, teaching aids, reference materials, safety equipment, and tools. Under certain conditions fabrication of apparatus would be allowed.

In 1976 only about seven percent of the proposals to ISEP came from two-year postsecondary institutions. In 1977 the percentage increased but the program still appears to have little impact on two-year colleges. However, considering the general tightness of money for hardware, and the potential for multiplying the impact of an institution's own funds, this program would seem to be deserving of consideration.

Colleges that are supported by local public political entities seem to encounter some difficulty in budgeting matching funds with greater frequency than private colleges. There is often a need in community colleges for administrative facilitation when it comes to budgeting for matching funds. First, if possible, funds could be budgeted in advance, to be used only in the event of an award. This potential to multiply the effect of local money should seem attractive to controlling authorities. Such preplanned funds would also serve as an encouragement to faculty interested in improving their offerings. Second, in the event that a proposal is submitted and funded, where the institution must now provide its matching share, a period of up to twenty-seven months from the award date is permitted for the award to be accepted (and matched). Since this period covers more than one fiscal year, considerable flexibility exists if needed. To submit an ISEP proposal, only a statement of intent to supply matching funds prior to the expiration of the grant is required. Prior obligation is not required.

(3) The Comprehensive Assistance to Undergraduate Science Education Program (CAUSE) provides grants to institutions of up to $250,000 over three years for activities to bring about improvements in the quality and effectiveness of science education. The thrust of this program is broader than LOCI and ISEP, involving plans from departments, groups of departments, divisions, or the entire science effort of an institution. Both equipment purchases and personnel activities are eligible for support. The comprehensive nature or breadth of the CAUSE proposal refers to the requirement that the impact of the proposed activity must have been assessed in terms of all aspects of the institution affected. Thus, a local needs assessment or "Local Review Statement" stating the project's goals and how they relate to the institutional context, objectives, and long-range plans is required as part of the CAUSE proposal. While local needs are sufficient to justify a request, applicants proposing activities with the potential for broader regional or national impact should clearly indicate that possibility. CAUSE is the largest program in SERI. In 1976

it was funded at $10 million and in 1977 at $11 million. In 1976 two-year colleges submitted 186 of a total of 760 CAUSE proposals. In 1977 two-year colleges submitted a total of 105 of a total of 483 CAUSE proposals. Success ratios for two-year schools and non-two-year schools are comparable. However, in 1977 the overall success ratio for both groups was substantially higher than 1976 because of fewer proposals and a greater amount of available funds to make awards. More than any other program in SERI, CAUSE has drawn the attention of two-year colleges. Because of the comprehensive nature of CAUSE proposals, administrative involvement and support is almost a necessity. Administrative interest may explain the substantially greater two-year college involvement in this program than the other SERI programs in that administrative interest may translate into a facilitation of CAUSE proposals not otherwise available for proposals to other programs.

III. The Science Education Development and Research Division (SEDR) operates two programs of interest, (1) Development in Science Education (DISE), and (2) Research in Science Education (RISE). Both of these programs aim to support unique and original efforts to address problems of national significance. The requirement that the problem addressed be of national importance is sometimes a stumbling block for colleges whose orientation is local needs. Techniques for demonstrating that a local need is also one of a widespread or national nature might include referring to the established educational literature, forming consortia of a broad geographical nature, or developing products which are easily and obviously disseminated and for which a well-defined need exists; i.e. high quality video instructional materials. Other mechanisms should also be considered. Considering the rapid emergence of the two-year college as a major institution in our society, and considering the special problems faced by these colleges with their unique student populations and with their transfer, career, and community service thrust, one would expect that significant proposals to RISE and DISE were possible. Because the problems addressed are of national importance, all costs including indirect costs are borne by the Foundation. There is no requirement for cost sharing or cost matching because in tackling such a national problem one is considered to be performing a service to the nation.

IV. The Office of Science and Society operates the Public Understanding of Science Program (PUOS). This program has goals that are consistent with the two-year college philosophy and should be considered by anyone seeking to reach a non-traditional audience. The program aims to promote informal adult education to achieve an increased public understanding of the scientific and technological components of major issues of public policy and personal judgement. It also seeks to increase the public's knowledge about the activities of scientists and engineers. PUOS will support efforts to improve communications between scientists and non-scientists. Because of their geographical dispersion, their philosophical and practical commitments to life-long education, their experiences with various non-traditional student populations, two-year colleges seem an ideal vehicle for this program. As an additional thought, the colleges benefit from such outreach efforts by making their community more aware of their other offerings and capabilities.

Requests for information from any of the Education Directorate's three Divisions should be addressed to the appropriate Division Director, National Science Foundation, Washington, D.C. 20550. Similarly, requests for information on PUOS can be addressed to the Director, Office of Science and Society, National Science Foundation, Washington, D.C. 20550.

The NSF Science Education Directorate operates many other programs which may be of interest to certain faculty, although they may not have the broad interest to two-year college faculty of the programs described. These other programs are summarized in an NSF brochure entitled, "Guide to Science Education Programs," which can be obtained on request from any of the Divisions. In addition, a useful newsletter published monthly is available by writing to the Editor, NSF bulletin, Public Information Branch, National Science Foundation, Washington, D.C. 20550. On request your name will be put on the mailing list. By writing to the Public Information Branch you can also obtain the Foundation's Organizational Directory which links individual Program Managers with the Foundation Programs and provides telephone numbers. It is often advantageous to be able to directly call the Program of interest instead of wending your way through information operators and layers of bureaucracy.

Specific questions should be addressed to the Manager of the Program. Generally, these staff scientists are happy to answer your questions, though at times work loads are very heavy. Proposal writers should generally expect to exert some persistence in discovering information needed, alternatives possible, and help or clarification which is reasonably due. Recognize that while managers generally are able to provide adequate time, they will, when harried, try to deal with your problem as rapidly as possible.

The Foundation has undergone substantial reorganization in the last few years. Change is still ongoing that will effect opportunities for two-year colleges to have equitable access to Federal support for their science education efforts. The process receives internal inputs from those Foundation officials that recognize the need for the NSF to have a greater impact in the community and junior colleges. Their awareness and consciousness have been raised. They have been "educated." The pressure for change has its principle sources external to the Foundation. Congress has taken an active role in defining NSF programs, eligibility requirements, and thrusts. Congress in turn responds to input from organizations like the American Association of Community and Junior Colleges. Faculty should make their needs known to such national professional organizations and keep alert to changes in Foundation programs which affect them. In this past year, Foundation Task Forces have studied prior two-year college participation, eligibility for participation in programs, peer review, and other issues. The impact of these studies should cause considerable change in 1978 to the advantage of two-year colleges.

Low Two-Year College Participation

Why is two-year college participation in Foundation programs so low? Several explanations of the generally low proposal pressure from two-year

colleges exist. Probably each is, at least in part, correct. The prior history of Foundation indifference to two-year colleges is often cited. The Foundation previously cast its science education efforts in the narrow direction of promoting education that would ultimately produce research-oriented PH.D's usually in the most prestigious colleges and universities. This led to a reputation for elitism. That orientation no longer exists. Emphasis now includes two-year colleges, technology programs, science for the general public, and science education for non-science majors. However, the image of a disinterested Federal bureaucracy takes time to dispel, and this may be a factor in the lack of interest in Foundation programs shown by two-year faculty.

A second and more important source of reasons for low participation lies in the two-year college context itself. Several factors mitigate against excellence in teaching, and concomitant fund seeking to improve quality. Faculty teaching loads averaging fifteen or more contact hours per week when added to preparation time, office hours, departmental and other professional responsibilities are excessive. Grant writing is a time and energy demanding activity. Faculty at other types of institutions typically teach nine contact hour loads (sometimes less). The difference is expected to be put into research, fund seeking, and their other professional interests in pursuit of excellence. Clearly, two-year college faculty are disadvantaged in competing for funds. Faculty need information about programs in order to prepare timely proposals. NSF information is often mailed to Presidents and Deans. It is imperative that such information be rapidly disseminated among the science faculty. Two-year college faculty lack experience, confidence, and incentive to write for grants. Faculty at four-year colleges and universities have a history of fund seeking both in the research and the education domain. Steps can be taken by colleges to compensate for the lack of experience and confidence in fund seeking. The issue of incentive and motivation is complex. It involves not only questions of professional interest in fund seeking, but the entire question of professional treatment of faculty. Does your institution promote professional interest or does the institution's environment promote turned-off faculty who displace their professional energies into other activities? Does the system reward, encourage, recognize, facilitate, and enhance professionalism? Or is the opposite true? Facilitation of the grant seeking process requires both planning and some college funds. The lack of a Grants Coordinator or Development Officer can impede the process. Institutional self-evaluation is a good first step in deciding whether low (or no) participation in NSF programs is the result of causes related to the specific institution's context. In the following section some suggestions are made for institutional activities and policies to promote successful faculty involvement in NSF funded programs.

Institutional Activities to Facilitate Successful Fund Seeking

The administration can facilitate faculty involvement by providing planning and seed money for grant seeking. The seed money can be in the form of support for professional travel to discipline based or other appropriate organizational meetings, inter-collegiate conferences, to NSF offices to review previously funded awards in the programs of interest, and for other directly and indirectly supportive activities. The issue of faculty isolation from peers requires some direct institutional remedy.

In addition, reductions in teaching load granted to targeted faculty or distributed as a fraction of Departmental FTE teaching load to specifically promote outside fund seeking can be employed.

The support of a Development Officer has already been mentioned. One aspect of development activities, faculty development, can be directed to overcoming the previously discussed handicaps of two-year faculty which disadvantage them in fund seeking. The administration can enhance successful fund seeking by employing appropriate outside consultants to review and discuss faculty plans for science education activities. Another route is to organize and foster workshops designed to upgrade the faculty's proposal writing skills. Development Officers can help to some extent with grant writing, but for the most part proposals must come from faculty who are intimately aware of the problems being addressed. Only when the faculty's skills in grant writing are high will the institution's success rate improve. It appears that once skills are acquired they persevere. Good proposal writers will probably write many successful proposals during their professional life. Helping to develop those skills in a faculty member is creating a long-term institutional resource.

Institutional support for activities like those just discussed can be viewed as "seeding" investments in a manner analagous to the investments of a venture capital firm. A few thousand dollars per year may well result in returns to the institution of hundreds of thousands of dollars. The administration can also promote fund seeking through non-financial activities. Planning for budget flexibility has been described. The promotion of cooperative efforts among faculty within an institution (or between institutions) and efforts at in-house evaluation of potential proposals are other activities which may enhance successful fund seeking. The latter activity will be discussed in the next section as a specific mechanism to increase the likelihood of receiving an award.

Advice on How to Succeed with Proposals to NSF

Recognize that you are entering a competition for an award. Justifiable need is not enough to merit an award. Writing a good proposal is not enough. Awards in a program are made until the money is all committed. Because of funding limitations, only the very best proposals receive awards. Success ratios vary from program to program and from year to year, but typically range between ten and thirty percent. A large fraction of proposals are poor, but probably half or more in any program are of sufficient merit to deserve funding if it were available. Your proposal must be high on the list of meritorious to be sure of support.

Peer evaluation of proposals is a key element in the award process. Incoming proposals to a program are screened for technical eligibility criteria. Then they undergo evaluation by panels of peers according to the discipline areas involved. The specific process differs in detail from program to program, but usually each proposal is evaluated by one or two panels of four or five members each. Keep this target audience in mind when writing. The peers are faculty and adminstrators from two-year colleges, four-year colleges, and universities. Almost all programs use panels where at least one member reading proposals from two-

year colleges is from that type of institution. In some programs, CAUSE for example, the majority of readers of two-year college proposals are two-year college faculty and administrators. The peer evaluation process results in reviews which provide ranking scores and reviewer comments on the strengths and weaknesses of the proposal. Using these review statements as a guide the Program Managers further evaluate the proposals for merit. Gnerally, programs separate their proposals into quality groups. Those in the first quality group are considered of highest merit and generally are all funded. Those in the second quality group are considered to be of sufficiently high merit to warrant further consideration for funding although they are not considered to be the equal of proposals in the first quality group. The second quality group is usually much larger than the number of proposals which will be funded from that group. Secondary criteria such as geographical factors, lack of prior awards, discipline area, minority participation, and institutional type submitting the proposal are used in the selection of awardees from the second group. Clearly, peer evaluation is of great importance in the process, and the peers are faculty and administrators hopefully not too different from those at your own institution.

The Program Manager then makes recommendations for awards which are carefully reviewed by the Division Director. These are then further studied by an Action Review Board for the Science Education Directorate which makes its recommendations to the Assistant Director for Science Education. People oftne question, "What does NSF really want?" The Foundation's goals are clearly spelled out in the guidelines for each program. There are no hidden NSF agendas. However, the peer reviewers may have such an agenda, or a faddish concern, or a bias regarding institutional affiliation or other characteristics of proposers. To the extent that peer review is like a grand jury process, you are at the mercy of the panels. The Foundation does exert efforts to construct fair and balanced panels of competent reviewers. Your best approach is to assume a reasonable review will occur and be straightforward in your approach. Don't try to second guess a review panel about which you know nothing in detail.

Each program publishes a booklet describing the program and proposals called a guideline. Follow the guidelines carefully and fully. The guideline is very specific and narrowly defines proposals. The guideline specifies goals and purposes, limits on number of proposals, eligibility, fiscal limits, proposal format, and other requirements. Usually the criteria to be used by the peer reviewers are also listed and described. Don't miss any point. Don't assume that anything is obvious. Fully respond to each criterion. There is one-to-one correspondence between the listed evaluation criteria and the forms used in the peer review process. Reviewers assign scores for each criterion. Omission of the information relevant to any one criterion may sufficiently lower your overall rating to result in a denial of your request. Provide some documentation of your claims wherever possible.

Clear writing is essential. Many of the proposals judged low in merit contain excellent and appropriate ideas poorly expressed. Depending on the program, reviewers average from one-half hour to perhaps an hour and a half per proposal. You must make your salient points obviously apparent. Clarity and conciseness are essential. If you need help in achieving this objective, get it before you send your proposal in.

The proposed budget should be adequate, but reasonable. Reviewers like to see the government's money well spent. They are turned off by expenditures that appear extravagant. If salary-related items are high because of contractual commitments, some footnote or other indication would be a wise addition. In this way no misinterpretation of inappropriateness or avarice will occur. It appears that a history of institutional interest and support is a helpful (although not absolutely necessary) factor in success with the peer review process. If your institution has a clear plan and has already carried out steps A,B,C; and now seeks some assistance in completing D,E, and F, it seems a favorable condition exists for a positive peer review. The case where you recognize the need for and request support for steps A-F may also receive a positive peer review, but it appears somewhat less likely. If some support, interest, planning, and action have already occurred, be sure to indicate it.

Self-evaluate. You don't have to wait for the NSF peer review process to occur before you know if your proposal is a good one. You know the criteria to be used (they are in the guidelines). Put together your own review panel using competent and disinterested faculty from your school and nearby schools. Ask them to critically evaluate your proposal both overall and on each criterion. Then evaluate their critique and if necessary, improve your proposal prior to submission to NSF. To carry this process out fully, an early start is recommended. Don't wait for the newest guidelines to be published. They usually come out during the late summer. Use last year's guidlines as a starting point for your first draft.

If you submit a proposal and are unsuccessful, then improve your proposal and resubmit the following year. Your proposal is the product of a creative effort. Even though unsuccessful (and most proposals are unsuccessful the first time), it has value. Consider modifying it and submitting to another funding source or to NSF again. The Foundation will send verbatim transcripts of the reviewer scores and comments to the proposed Project Director on request. Only the Project Director, no other person, can receive these. Obtain them. They will indicate what the review panel perceived as the strengths and weaknesses of your proposal. Judge these comments carefully. If they seem valid, they can serve as an aid to improving your proposal. Recognize though that you may not agree with the panel's judgement, in which case you may wish to resubmit your proposal essentially unchanged. Perhaps your proposal was quite good and in the second quality group, but it was unfunded because of other considerations than merit. Again, you may want to resubmit your proposal with little change. There are no rules on when to change a proposal. Only your best judgement will tell you.

Advantages of Fund Seeking

There are some positive advantages of fund seeking even in the case of rejection. The most obvious is that no proposal can come forth without some prior efforts at self-evaluation. Such self-evaluation may involve individual faculty, departments, administrators, institutions, or trustees depending on the breadth of the proposal. Of itself, self-evaluation is a positive event promoting revitalization and improvement. It casts the spotlight on problem areas in need of attention.

A second advantage is inherent in the review process. Proposals, and by implication components of an institution's delivery of science education, receive critical external review by high quality reviewers. If impediments to progress exist, whether they are in the administration, in the Board of Trustees, or in the authority controlling institutional funding, external professional review may serve to pinpoint them. Such impartial and highly focused reviews may serve as leverage in stimulating an institution's own efforts at self-improvement.

Often faculty members may have a creative idea, but they are unsure of its merit. By submitting to peer review the relative value of the idea can be assessed. The NSF guidelines will help one focus on the various aspects of the idea. Thus,the very process of writing enhances the development of a concept. Two-year college science education would benefit in many tangible and intangible ways by a broad-based participation in competitive fund seeking.

But certainly the greatest rewards occur with successful fund seeking. Faculty, students, and administrators all benefit. Needs are addressable and problems attackable with external funding. Morale may also benefit. Very often the example of progress serves as a stimulus for efforts of other faculty to address the needs that they perceive. One successful award may provide the activation an institution requires to generally upgrade and improve the quality of its educational efforts.

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